CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT
CD NO. [redacted] 50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1948
SUBJECT	Scientific - Mathematics, machines		
HOW PUBLISHED	Monthly periodical	DATE DIST.	24 Jan 1951
WHERE PUBLISHED	Moscow	NO. OF PAGES	10
DATE PUBLISHED	1948		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, No 8, 1948, pp 1351-1357, [redacted] 50X1-HUM

WORKS OF THE SEMINAR ON FINE MECHANICS AND COMPUTATIONAL TECHNIQUES, CONDUCTED BY ACADEMICIAN N. G. BRUYEVICH, NOVEMBER 1947 - JUNE 1948

O. N. Korsakov

The Seminar of the Division of Fine Mechanics, Institute of Machine Studies, Academy of Sciences USSR, has been at work since January 1946. Over the past $2\frac{1}{2}$ years there have been more than 100 sessions participated in by more than 30 speakers.

The seminar is conducted in cooperation with the Division of Approximate Computations, Mathematics-Institute imeni V. A. Steklov, Academy of Sciences USSR, and several laboratories of the Power Engineering Institute imeni G. M. Krzhizhanovskiy, Academy of Sciences USSR, and also with various research and planning organizations dealing with computer techniques and fine mechanics.

The seminar meetings consist mainly of lectures on the problems connected with theory, construction, accuracy, rational applications, and problems of development of all types of digital and analogue machines; in addition, various methods of solving mathematical problems are surveyed.

The seminar lectures, which are worthy of the greatest attention, are published periodically (see Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, No 8, 1946, and No 5 and 11, 1947).

A short description of the seminar's work for the period November 1947 - June 1948 is presented below.

The seminar meetings of this period began with a series of I. Ya. Akushskiy's lectures on various methods of calculating the sums of products on a

CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

STATE	X	NAVY	X	NSRB		DISTRIBUTION
ARMY	X	AIR	X	FBI		

CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

CENTRAL INTELLIGENCE AGENCY
INFORMATION FROM
FOREIGN DOCUMENTS OR RADIO BROADCASTS

REPORT
CD NO.

50X1-HUM

COUNTRY	USSR	DATE OF INFORMATION	1948
SUBJECT	Scientific - Mathematics, machines		
HOW PUBLISHED	Monthly periodical	DATE DIST.	24 Jan 1951
WHERE PUBLISHED	Moscow	NO. OF PAGES	10
DATE PUBLISHED	1948		
LANGUAGE	Russian	SUPPLEMENT TO REPORT NO.	

THIS IS UNEVALUATED INFORMATION

SOURCE Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, No 8, 1948, pp 1351-1357,

50X1-HUM

WORKS OF THE SEMINAR ON FINE MECHANICS AND COMPUTATIONAL TECHNIQUES, CONDUCTED BY ACADEMICIAN N. G. BRUYEVICH, NOVEMBER 1947 - JUNE 1948

O. N. Korsakov

The Seminar of the Division of Fine Mechanics, Institute of Machine Studies, Academy of Sciences USSR, has been at work since January 1946. Over the past $2\frac{1}{2}$ years there have been more than 100 sessions participated in by more than 30 speakers.

The seminar is conducted in cooperation with the Division of Approximate Computations, Mathematics-Institute imeni V. A. Steklov, Academy of Sciences USSR, and several laboratories of the Power Engineering Institute imeni G. M. Krzhizhanovskiy, Academy of Sciences USSR, and also with various research and planning organizations dealing with computer techniques and fine mechanics.

The seminar meetings consist mainly of lectures on the problems connected with theory, construction, accuracy, rational applications, and problems of development of all types of digital and analogue machines; in addition, various methods of solving mathematical problems are surveyed.

The seminar lectures, which are worthy of the greatest attention, are published periodically (see Izvestiya Akademii Nauk SSSR, Otdeleniye Tekhnicheskikh Nauk, No 8, 1946, and No 5 and 11, 1947).

A short description of the seminar's work for the period November 1947 - June 1948 is presented below.

The seminar meetings of this period began with a series of I. Ya. Akushskiy's lectures on various methods of calculating the sums of products on a

CONFIDENTIAL

CLASSIFICATION CONFIDENTIAL

STATE	X	NAVY	X	NSRB		DISTRIBUTION
ARMY	X	AIR	X	FBI		

50X1-HUM

tabulator. First, Akushskiy noted that the operations of obtaining sums of products are often encountered in the solution of various mathematical problems: multiplications of vectors and matrices, solution of systems of linear equations, numerical integration, etc. As is well known, the basic machine in a digital complex -- the tabulator -- very effectively executes the operations of summation in various modifications. Akushskiy then reported on a method for obtaining products by accumulating sums, as worked out by I.N. Yanzhul. This method, however, requires much time in computation and does not employ all the counters present.

Later, Akushskiy discussed a method proposed by him, which has turned out to be highly effective; it is based on the binary representation of numbers and utilizes horizontal operations in a tabulator (as the transfer of the indices of the same number into itself). The advantage of the proposed method was demonstrated by Akushskiy in solving a system of linear equations.

Akushskiy later developed in detail the determinant of a secular equation, in which three methods of computation are possible:

1. Leverrier's method, which consists of successive direct computations of the degrees of a matrix followed by diagonal summation.

2. Krylov's method -- the multiplication of a definite vector by a matrix -- is a method of great simplicity in the multiplication of operations, but certain complications occur in the adjustment process.

3. The method proposed by Danilevskiy, which consists in the reduction of a secular determinant to Frobenius' normal formula, is very effective in manual computations, but is of slight effectiveness in large-scale computations.

In conclusion, the lecturer gave a detailed comparative evaluation of all the methods discussed by him.

In the sessions that followed it was proposed to Akushskiy that greater attention be paid to various forms of control, both of the machine's operation and of the operator's participation, which are difficult. Also, it was proposed that a unique symbolism be worked out in the operation of analogue machines which would reflect the performance and operations effected by a machine

Lectures on several problems of accuracy of geared transmissions were given by Academician N. G. Bruyevich, B. A. Tayts, and O. N. Korsakov.

Academician Bruyevich in his lecture on the fluctuation of the transmission ratio in geared transmissions explained the phenomenon that occurs when a new pair of teeth is introduced into the gearing. He noted that intermittent or skipping variations in the transmission ratio, leading to a variation in the angle of turn of the driven wheel, occur from the presence, in the real geared mechanism, of certain primary errors to the moment that the new pair of teeth are introduced into the gearing.

From the condition governing the position of the mechanism when a new pair of wheels is in gear, N. G. Bruyevich succeeded in finding the intermittent variation in the transmission number. It turned out that the increase in gear angle is very important in this phenomenon, in consequence of the possibility of contact of a tooth by a rib. The physical solution of the equations given in parametric form permits one to determine the actual gear angle /angle of meshing or angle of contact/.

Later, the lecturer discussed the solution for a group of mechanisms for the case of chance errors.

Investigations of the fluctuation of the transmission ratio in geared transmissions, as conducted by Bruyevich, revealed the influence, on the accuracy of the transmission ratio, of the form and height of a tooth. In conclusion, he analyzed the influence of deformations in this phenomenon.

B. A. Tayts reported on the problem of selecting systems of primary error readings in geared wheels. First, the lecturer cited three basic considerations by which one should generally be guided in selecting the systems of primary error readings: technological, metrological, and exploitational considerations. Noting the difficulties which arise in attempts to satisfy all the requirements mentioned, Tayts analyzed, from this viewpoint, the three bases for systems of reading which are possible in a geared wheel; he decided that the most rational basis was that which is founded on the initial contour of the evolvent wheel, and cited certain arguments in defense of this selection.

Later, the lecturer turned to the subject of selecting the reading origin in the profile of a wheel's tooth; after recounting all possible cases, he settled on the so-called point of constant chord of the tooth's depression. He then proceeded to discuss primary errors and established three basic errors in gear wheels: profile errors, error of main pitch, and the error of revolution tracing the tooth in the gear plane /plane of contact/. In view of the large role of eccentricity in the errors of gear wheels, the lecturer noted the possibility of resolving this error into a class of mutually independent errors.

In the second half of his lecture, Tayts concentrated on the influence of the wheel's eccentricity. He analyzed the nature of its cause and methods for observing kinematic geometric eccentricities for various forms of manufactured gear wheels, and also the possibility of their mutual compensation.

O. N. Korsakov's lecture was devoted to displacement errors in gear wheels. Cases exist where displacement errors attain a magnitude of the first order. He analyzed the fundamental formulas for the displacement error in a geared mechanism and in various cases involving the manufacture of a group of identical mechanisms. In conclusion, he proposed graphs for the rapid determination of the greatest possible value of displacement errors in the case where gear wheels are manufactured according to GOST (State Standard Specification).

A lecture on an apparatus for graphical integration was given by A. B. Shtykan, who generalized earlier reports and described an arrangement for taking the Stieltjes integral and for solving first-order differential equations. The device proposed by Shtykan for integrating complex functions in polar coordinates consisted of an immobile disk with a wheel revolving around it. With the wheel, in turn, is connected, by means of a "progressive couple," an Abdank-Abakanovich wheel mount, which is constantly pressed by means of a spring against a special curve pattern. Afterward Shtykan showed several possible modifications obtained from the basic device and showed a similar device designed for integrating a function in rectangular coordinates.

I. S. Bruk, corresponding member of the Academy of Sciences USSR, gave an interesting report at the seminar on a multiplying device of a purely electrical type. At the basis of this device is the identity

$$(x + y)^2 - (x - y)^2 \equiv 4xy.$$

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

To effect the right-hand side it is necessary to create the quadrator [squarer]. The quadrator is effected by generating a saw-tooth voltage that fluctuates in time. The areas of the "sectioned" triangles are proportional to the square of the voltage. The entire computer device operates in the following manner: The summing devices (amplifiers) generate the sum and difference of x and y; these quantities proceed then to the quadrators and are subtracted at their output in the amplifiers. A computer device of this type permits one to make an electrointegrator in which one factor is the integrated function and the other function is a time derivative of an independent variable quantity, the integration being carried out with respect to time.

Later, I. S. Bruk cited some examples of various applications of this device to division, extraction of roots, and differentiation; he also indicated its possible employment in automatic regulation for nonconverging processes.

An example of the application of the device to the actual solution of certain concrete mathematical problems was demonstrated by Bruk on a problem solved by L. V. Kantorovich (in a lecture given in May 1947 at a seminar). The process of solving systems of equations on the device merely comes to "variation by verniers," with the aim of obtaining the least sum of the deviations squared. In the case where a system of equations does possess a solution, as was shown by Kantorovich, one obtains zero; if the least reading differs from zero, then the solution obtained will have a mean-square error that is a minimum.

In conclusion, Bruk contemplated the possible application of this scheme to the solution of even nonlinear equations.

In the discussion that followed, N. G Bruyevich indicated the existence of mechanical frictional quadrators and showed examples illustrating ways to obtain any power (besides the second power, as with the quadrator) by varying the transmission number of the frictional mechanism. Others also offered positive evaluation of the device discussed in Bruk's lecture; they noted that the problem of obtaining the product by purely electrical means is very alluring but also pointed out, as defects of the device, the multiplicity of operations, which are sources of additional errors.

A series of lectures on the alternating-current network-analyzer (calculating board) was given by three co-workers of the Power Institute imeni Krzhizhanovskiy, Academy of Sciences USSR: M. S. Libkind, S. S. Chugunov, and P. I. Zubkov. This network-analyzer of the institute is a universal analogue device which is intended to model complex power and mechanical systems and which permits one to conduct effectively careful and accurate analysis of the behavior of present-day powerful electric power systems in normal and emergency situations.

M. S. Libkind reported on the development of calculating boards. He noted that present calculating boards date from 1916. At the basis of the first calculating board was the so-called equivalent circuit scheme with inductive elements. The prospects of this device were accurately evaluated and number of boards began to grow very rapidly. The first Soviet calculating board using alternating current was constructed in the All-Union Electrotechnical Institute in 1929 - 1930. A little later, ac calculating boards began to appear in the USSR and foreign countries.

Later, the lecturer noted the increase in the quality of these boards, their complicated design, and widening of their functions. A critical change in the development of ac calculating boards was the transition from the standard frequency of 50 cycles to a higher one which permitted a considerable decrease in the size of the boards. Libkind gave a qualitative evaluation of

CONFIDENTIAL

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370446-6

50X1-HUM

the institute's board and noted that in its perfection of design and construction it excels the latest American calculating board. Among the excellent qualities of the Soviet model are the following: fine stabilization of feed voltage and frequency; disposition of the generator units within the limits convenient for manipulation of one operator sitting at the desk and panel; a convenient push-button system for "summoning" any element of the circuit scheme to the measuring complex; compact commutation field; etc.

The construction and operation of the calculating board were described by S. S. Chugunov. The board is supplied from a special ac 400-cycle generator with a rated voltage of 50 v and rated current of 50 ma. The table possesses 14 ac sources, which represent the generators or power stations of the electrical system under study, and contains as many as 300 R, C, L elements for setting up the various circuit schemes governing the substitution and conversion of transformers, transmission lines, and loads in the system. Such a quantity of generator units and elements make it possible to reproduce a very complex physical system on the calculating board.

To facilitate computations on the board, relative units are employed: the rated voltage of 50 v and rated current of 50 ma are taken as unity (100%); unit resistance is 1,000 ohms. All measurements on the computing table are conducted by one complete series of measuring instruments, which are set on the control panel and desk and which can be connected to any element of a circuit scheme by means of relays.

The lecturer characterized in detail the accuracy of the calculating board. The magnitude of voltage and frequency are maintained with an accuracy greater than 0.1%. The errors of individual elements, taken separately, do not exceed 0.3% of the selected units. Excluded are the variation of inductance with current and the losses in the inductive coils, which exceed 0.3%. All this means that the accuracy of measurements on the calculating board during its employment for the analysis of electrical-power systems is within 3 to 5%.

The calculating boards are valuable not only as a means of analyzing the operation of power systems. They, and many other special analogue installations, can be successfully employed to solve many problems in other fields of science and technology. The electrical circuits "composed" on the calculating board consist of ac sources and R, C, L passive elements with linear characteristics. The composition of these circuits is characterized by a system of algebraic equations with complex coefficients. The results of measurements on the board represent the solution of this system. In this way, the calculating board can be utilized to solve a system of algebraic equations and certain other mathematical problems.

P. I. Zubkov gave a report on one of the uses of the ac calculating board for tabulating experimentally the ratios of two modified Bessel functions. This problem boils down to calculating the continuous fractions which are realized on the calculating board in the form of a circuit scheme made up of Γ-shaped "half-links." The solution of the problem is represented by the total conductance of the minor circuits indicated above. The method of computing used by Zubkov permitted him to shorten the computation by five to six times, and results of experimental and calculational tabulations diverged not more than 2% (see <u>Izvestiya Akademii Nauk SSSR</u>, <u>Otdeleniye Tekhnicheskikh Nauk</u>, No 4, 1948

50X1-HUM

The division's seminar also heard a lecture by F. M. Di...ntberg on a method for determining the positions of spatial mechanisms with cylindrical couples. The essence of the method proposed by the lecturer is as follows: With respect to given internal parameters (lengths of links, or members; angles; etc.) and given angle of turn of the drive link, one determines the

50X1-HUM

angles through which all the remaining links are rotated around the axes of the corresponding joints, if for the original position one takes the unfolded position of the chain which is obtained after the elimination of any link. With the aid of a formula giving the final turn, one determines the positions of the axes that accomplish the final displacement. After this, one expresses the condition that governs the connection restoring the eliminated link; then one obtains the algebraic equation that connects the parameters governing the angles of turn. To shorten the mathematical description, Dimentberg employed the complex vectorial method proposed in 1895 by A. P. Kotel'nikov. This method permits one to carry out operations on "sliding" vectors and "screws" in space in a formal manner just as on free vectors. In this connection, the vectors together with moments are expressed as complex vectors whose laws of addition and multiplication do not differ from the laws of addition and multiplication of ordinary vectors; the relations that depend on angles and positions of vectors are obtained automatically by separating the real and imaginary parts of the equations.

The lecturer discussed in detail a four-link mechanism; he dealt with the case where passive couplings exist and also pointed out the theoretical behavior of the solution for multi-linked mechanisms. In the debates that followed, it was proposed to the lecturer that a comparison of the solution according to his method with the solution according to the methods of G. G. Baranov and N.I. Mertsalov be carried out.

Several lectures on the laws governing the distribution of chance quantities were given by N. A. Borodachev.

In his first reports, the lecturer discussed briefly the various phases of development in the history of the laws governing the distribution of chance quantities; he thoroughly criticized foreign schools of descriptive statistics, which give purely interpolational curves of distribution (Pearson, Charlier, etc.). The latter curves are unrelated to reality and to the peculiarities of chance [stochastic] phenomena. He reported on the work which he had carried out on obtaining theoretical curves of distribution for chance quantities which are themselves the sum of many chance quantities.

Borodachev discussed the case where the various conditions surrounding Lyapunov's limit theorem, which governs the generation of a Gaussian distribution, are violated. After a short analysis of the cases where the first three conditions of Lyapunov's theorem are violated -- limitation of the dominating role of the individual terms, the reciprocal independence of the terms, and the tendency toward infinity of the number of terms -- the lecturer discussed in detail the case where the condition governing the invariability of the fundamental characteristics of chance quantities with time is violated, namely, the average value and the mean square deviation. That is, Borodachev assumed that these quantities are functions of time, and hence not only both characteristics, i.e., equations, but also each of them separately can vary in time simultaneously.

As a result, Borodachev proposed three families of distribution curves: (1) with varying mean square deviation, (2) with varying average value, (3) with both a mean square deviation and an average value varying in time.

Numerous questions and animated discussion followed Borodachev's report, to which one meeting of the seminar was devoted. The adequacy of reasons for Borodachev's proposed way of setting up a system of distribution curves was disputed in speeches by the participants; in addition, defects were pointed out in his employment of limit theorems in the theory of probability.

In succeeding lectures, Borodachev reported on changes which he made in the proposed system of distribution curves to correct deficiencies mentioned at previous meetings of the seminar. With this purpose, he abandoned his discussion on the violations of individual conditions governing Lyapunov's limit theorem and formulated the nature of the structure of a sum and the properties of the terms for each of the proposed family of non-Gaussian distribution curves.

At the same sessions, Borodachev lectured on partial results from the still-unfinished second work which he and B. M. Shchigolev, are conducting to clarify the possibility of establishing, with respect to practical distribution curves and other statistical data, the nature of a chance process that reduces to the distribution obtained. He reported on a procedure that he had worked out for analyzing statistical data in detail under laboratory conditions.

In the debates that followed, the participants noted the complexity and difficulty of the proposed method; they also pointed out that the authors have not formulated, in the problem under study, the general rules and theorems.

D. P. Grossman gave a lecture on the application of digital computing machines to the solution of systems of linear algebraic equations of special form by the method of iteration. He discussed two possible methods of solution. The first method, with the use of a tabulator and reproducer, is based on a method involving the computation of sums of products, as proposed by I. Ya. Akushskiy. The second method requires multipliers and sorting machines.

The lecturer briefly described several variants as proposed by I. Ya. Akushskiy for obtaining products and sums of products on a tabulator by controlling the operation of counters from a system of notches given in binary expansion of the factors. After selecting the most suitable variant, he described in detail all the necessary operations on the punch cards and the proper arrangement of the tabulator, calling attention to places where automatization is possible.

Grossman also described the solution of the same problem by the second method using a multiplier and sorting machine. He compared the two methods, noting the advantage of the second method and the greater accuracy of computation in comparison with the first; the second method requires, however, a great expenditure of time because of the absence of automatic operation and difficult control.

L. A. Lyusternik, corresponding member of the Academy of Sciences USSR, and V. A. Ditkin reported on the setting-up of formulas for use in the approximate calculation of multiple integrals. They formulated a general method for the setting-up of cubature formulas. This method determines the coefficients which are multiplied by the integrand functions at several points, after which the summation of the resulting products is carried out. After discussing thus the general expressions lying at the foundation of the proposed computations, Lyusternik and Ditkin demonstrated several examples: the integral over the area of a circle of unit radius which is computed through points at the apices of a regular n-sided polygon, and the value at the origin of the coordinates. They also showed several examples of integrals that are frequently encountered in practice.

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370446-6

The lecturers explained how to use the proposed formulas if the integration over the volume of a sphere or entire space is known; in this case too they considered several examples. In addition, they evaluated the error obtained in substituting the integrals of a sum by Taylor formula. In conclusion, they demonstrated the results of tentative computations carried out with the proposed formulas.

A lecture on the construction of an electrointegrator -- an apparatus for the solution of a system of differential equations -- was made by N. V. Korol'kov. Reports on the construction principles and operational peculiarities of this type of electrointegrator were made earlier (see Izvestiya Akademii Nauk, Otdeleniye Tekhnicheskikh Nauk, No 5, 1947).

The part that was new in Korol'kov's report was the results of $1\frac{1}{2}$ years' exploitation of a perfected working model of the electrointegrator.

After reviewing the construction and principle of operation of the electrointegrator, N. V. Korol'kov dwelt in detail on the technique involved in the preparation of the equations and on the method of assignment of the coefficients in the working model of the electrointegrator. The lecturer pointed out that if the equations are described in the form of matrices of coefficients, then both the preparation of the equations and the collection, or "setting up," of the coefficients present no difficulty. Additional systems of equations for assigning the right-hand side can easily be obtained with the aid of a table of operational relations.

In conclusion, Korol'kov cited examples of certain solved problems and showed solutions on the phase plane.

Lectures on the computation of the active functional resistances of the first kind in potentiometric apparatuses were given by Ye. I. Dmitriyev and F. V. Mayorov.

Dmitriyev reported on the computation of planar and globular shaped resistances, in which the functional dependence of resistance on slide position is effected by one or another form of the shell housing, he also reported on resistances with variable spacing of the coil. For functional resistances, Dmitriyev proposed a formula that gives the running value of the height of the housing in dependence on the form of the given function and parameters of the wound wire. Similarly for the second case, he gave the dependence of density of winding on the form of the assigned function and parameters characterizing the resistance of the wire. However, the limit of variation of coil spacing is 3. Afterward, Dmitriyev, by way of demonstration, computed the functional voltage dividers. If the functional voltage dividers are under a load, then the output voltage will have certain errors.

On the basis of Ohm's and Kirchhoff's laws, Dmitriyev introduced a formula for resistance which takes into consideration the influence of load. After conducting such a computation for two-cascade voltage dividers, Dmitriyev discussed the difficulties in computation that arise in the case of three-cascade and higher voltage dividers. Calculations of three-cascade voltage dividers without methodological errors are practically impossible. In this case, the lecturer recommended the introduction of corrections into the input voltage or that a special sequence be followed in the way that the succeeding two cascades are brought into action with the preceding cascades.

F. V. Mayorov reported on the manufacture of functional potentiometers from ordinary linear ones by shunting them to various parts. The essence of this method consists in the substitution of the given curvilinear dependence by a certain broken one, the number of segments of which depends on the sharpness of the dependency and the satisfaction of the necessary accuracy.

The use of the method proposed by Mayorov was demonstrated in a potentiometer that effects a sinusoidal dependence. In the usual case for the attainment of an accuracy of 0.2%, a sine potentiometer requires seven sections; however if one uses a variable coil spacing in the limits 1:3, then it turns out that three shunting sections are sufficient.

Several sessions of the seminar were devoted to M. L. Bykhovskiy's report on the accuracy of electrical circuit schemes. In the development of the theory of accuracy of mechanisms, as created by Academician N. G. Bryevich, Bykhovskiy proposed a theory of accuracy for electrical circuits. He determined the primary errors of a circuit and the errors of the output voltage. His development of transformed electrical circuit schemes for the purpose of determining the partial derivative which is the analogue of the mechanism was very interesting and important. Employment of transformed electrical circuits permits one quickly and easily to determine the influence of any primary error on the output voltage.

Bykhovskiy discussed, from the viewpoint of accuracy, circuit schemes (1) that consist of active resistances, (2) with alternating current and reactive resistances, (3) with nonlinear resistances, and (4) for the solution of linear equations. The lecturer gave a probable analysis and cited several examples that demonstrated the effectiveness of his proposed method.

Bykhovskiy also gave, on the basis of published information, a survey report on the construction of digital computing machines of the electrical type. He discussed the operating principle of the trigger circuit. Its construction consists of two triode tubes, whose circuit and anodes are cross coupled. Such a system, depending on the pulses in the circuit networks, possesses two stable states, where one of the tubes passes a current but the other is closed. Later, the lecturer showed how one can create from these circuits a counter, and described also the construction of certain supplementary components -- namely, the pentode tube, the importance of which is due to its rapid operations. It has a carry-over mechanism that uses a decimal base, as opposed to the binary base, an arrangement for extinguishing the counter, and a very clever device for remembering the numbers by means of a piezoquartz tube filled with mercury.

A distinguishing feature of these digital computer machines is their great counting speed, with which no others can compare.

Among the lectures on the accuracy of mechanisms was one by V. G. Sereda entitled "Investigation of Errors and Tolerances in the Locomotive's Steam-Distributing Mechanism." The lecturer formulated the problem of accuracy for a locomotive's steam-distributing mechanism and discussed the answers to two basic questions in this problem: analysis of errors and accuracy of the mechanism and synthesis of the mechanism according to reasonable accuracy and to technological conditions governing the manufacture of the mechanism's parts.

Analysis of the accuracy of the locomotive's steam-distributing mechanism, which is an "Assur" mechanism of the first class, fourth order, was conducted by V. G. Sereda by a method which he called "differential projections." This method involves the determination of partial derivatives by differentiating the equations of balance and continuity in the form of projections of the mechanism on the coordinate axes.

The graphs which the lecturer demonstrated of the transmission ratios, set up with respect to the 12 positions of the mechanism, made it possible for him to evaluate the tolerances due to manufacture and wear of the steam-distributing mechanism. Experimental data enabled him to set up the analytical dependence between the error of the slide position and the error in cut-off.

CONFIDENTIAL

CONFIDENTIAL

50X1-HUM

The lecturer next took up the synthesis of the mechanism according to accuracy, and determined the requirements made on the steam-distributing mechanism from this viewpoint. He noted the possible principles by which one must be led in selecting the tolerances, and the technological and mathematical criteria by which one can be led to choose one or another principle governing the assignment of tolerances. In conclusion, the lecturer proposed two systems of tolerances for the parts of the steam-distributing mechanism; these systems make up the second and third classes of accuracy.

The seminar proposes that the following problems be studied after September 1948: (1) the solution of mathematical problems by punch-card machines; (2) mechanical and electrical modeling and solution of certain problems by means of electrointegrators; (3) the accuracy of various analogue computers and of certain mechanisms; (4) certain methods and problems in approximate computations, the operational method, tabulation of functions, etc. Information concerning works on the automatization of calculations and computations in the USSR and abroad will be discussed in the next seminar.

- E N D -

CONFIDENTIAL

Sanitized Copy Approved for Release 2011/09/27 : CIA-RDP80-00809A000600370446-6